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Colony Collapse Disorder(CCD)

Honey bees have received more press in the last six months than I can remember in my entire career. Although the reports have been of serious winter losses in the United States, the good news from the coverage is that people now recognize the value and importance of honey bees for pollination.

There has been a significant amount of speculation as to the causes – everything from global warming to cell phone towers. Most of this speculation is somewhat far fetched. However, the situation is serious and apiculture experts in the United States are putting a tremendous amount of effort and research into determining the cause of the problem and to rectify the situation. At present, a number of potential problems are being researched. It is quite likely that the problem may be caused by a number of individual factors, which together create stresses that overcome the colony.

The information in the following pages is a synopsis of the situation surrounding CCD, presented by the Canadian Association of Professional Apiculturists.

CPPA Statement on Colony Collapse Disorder (CCD)

By Stephen F. Pernal, Ph.D., President, CAPA
www.capabees.ca

What is CCD?

CCD is a newly-described disorder of honey bees in which colonies rapidly and unexpectedly die; it is widespread in the United States and has been reported in some European countries. The disorder is characterized by the rapid loss of adult bees from hives leaving behind the brood (larvae and pupae), a small number of young workers and the queen. The remaining adult workforce is insufficient to care for the brood, and the colony collapses. Characteristically, dead bees are not found in the vicinity of the colony.

What has Happened in the U.S.?

CCD was first reported in the Eastern U.S. in November 2006. To date, the disorder has spread to at least 27 states. Large commercial migratory beekeepers have been reporting losses of 30 - 90 per cent of their colonies with many surviving colonies being too weak to pollinate crops. Some estimates suggest an overall decline in American honey bee numbers by 40 per cent.

The U.S. CCD Working Group has identified a number of factors that are being examined as cumulative stressors on colony health. These include the effects of migratory beekeeping practices, nutritional deficiencies, the effects of known and unknown pathogens, parasitic mites such as varroa, a lack of genetic diversity among breeding stock, the effects of systemic pesticides and improper use of mite control products. One or a combination of these factors may cause CCD; no specific cause of CCD has been identified at present.

On March 29, 2007 the House Subcommittee on Horticulture and Organic Agriculture held a hearing to review recent honey bee declines in the U.S. The Pollinator Protection Act was introduced in the House of Representatives. This legislation authorizes over \$75 million (USD) in funding for sustained research on CCD and the decline of pollinators in the U.S.

Current Status of Honey Bees in Canada (Spring 2007):

During spring, the first indication of abnormal problems with honey bee colonies is an examination of colony death sustained over winter months (overwintering mortality). Based on current information, the table below indicates the number of colonies that did not survive the winter, which includes

colonies that died during the spring or were culled because they were too weak. Winter losses reported by province:

Province	# Colonies Dead	Wintering Losses (per cent of provincial total)
British Columbia	11,308	23
Alberta	77,500	31*
Saskatchewan	24,000	24
Manitoba	22,950	27
Ontario	28,379	37
Quebec	12,429	30**
Nova Scotia	3,900	20
New Brunswick	4,990	59
PEI	1,054	29
CANADA	186,510	29 (per cent of national total)

*Provincial Apiculturist estimates that an additional 15 per cent of the colonies are very weak (less than three frames of bees) and are not expected to produce much honey this year (submitted 1 June).

**Estimated – final estimates to be compiled by 15 June.

Long-term average overwintering mortality in Canada is approximately 15 per cent. Nationally, overwintering mortality appears to be higher than normal at 29 per cent. This represents 1.9X the rate of normal winter losses. This rate, though certainly higher than average, does not represent unprecedented levels of honey bee die-off over the winter.

Average wintering losses in certain areas such as the Province of New Brunswick (59 per cent) (representing only three per cent of the country's colonies) and the Niagara region of Ontario (60-70 per cent) were very high in 2006-07.

Though high losses for individual producers may occur in any given year, high regional losses are of much greater concern. Across the country any unusually high losses have been investigated by provincial apicultural specialists. Initial indications suggest that high wintering losses may be attributed to some identifiable causes:

1. Ineffective control for the parasitic mite Varroa destructor. In many regions, this mite has now developed multiple pesticide resistance. This is making it increasingly complex for producers to monitor and treat these pest populations effectively.

2. Unusual fall and winter weather. Some regions of the country experienced warm fall and winter weather. These conditions contributed to build-up of higher than normal parasitic mite loads. In some areas, prolonged nectar availability until late into the fall also delayed the window in which mite controls could be applied. In other regions, inadequate nectar flows during fall months prevented sufficient bee population build-up prior to winter. The deviations in normal seasonality may also have affected the natural production of "winter bees" physiologically adapted to survive winter conditions.
3. A late wet spring in most areas prolonging winter conditions for bees and their access to suitable spring forage.

Is CCD in Canada?

Symptoms of CCD as described from the U.S. have not been diagnosed by professional apiculturists in Canada. Nevertheless, experts remain extremely concerned about the state of honey bee health in Canada and are monitoring the situation with great care.

What else is being done in Canada?

Researchers in Canada remain in close contact with principal scientists assigned to the U.S. Working Group on CCD. Members of CAPA have also been actively monitoring the status of bee health across the country and are sharing scientific information.

Adult honey bee samples from across the country have also been collected for the detection of the unicellular parasite, *Nosema ceranae*. This organism was previously discovered in the Asian honey bee, *Apis cerana*, in 1996. Recent research in Europe identified it as also being present in European populations of the western honey bee, *Apis mellifera*, as well as displacing populations of its native parasite, *Nosema apis*. In Europe, *Nosema ceranae* has been implicated in high honey bee losses in countries such as Spain. Analysis of samples collected from Canada will provide information about the organism's distribution in this country. The impact of *Nosema ceranae* on honey bees is not well understood and it is likely a factor in the survival of colonies already under multiple stresses. Researchers will remain involved with examining the impact of this organism on colony health.

2007 Crop Forecast

It is very early to make any predictions about this year's honey crop. However, the general indication from producers I have spoken with indicates that the crop will be much less than last year's record crop and in fact could be lower than the ten-year average. It seems that strong colonies managed to take advantage of the canola flow. However, in most areas the canola flow was curtailed significantly due to the extremely high temperatures that occurred during the canola bloom. In some places the flow from the canola was as short as seven to ten days.

As well, the higher than normal winter loss meant that many producers were making new

hives by taking brood from the strongest colonies. Most of these nucleus colonies did not get strong enough to produce surplus honey during the short honey flow.

It is anticipated that the crop across western Canada will be significantly reduced from last year. High winter losses in Alberta and Manitoba have also contributed, along with the weather, to a significantly reduced crop from previous years.

I will be conducting a fall survey. However, due to personal circumstances it will likely be later in the year. In the meantime, I would ask for and appreciate your contributions to this survey. For those of you who

have email I would appreciate receiving a message from you letting me know the following:

1. Total number of pounds produced;
2. How many colonies were used to produce that crop;
3. How many colonies are being placed into winter.

I would appreciate as many responses as possible. I will be contacting the commercial producers later in the season but I would truly appreciate all of those hobby beekeepers (like myself) to send me that information via email (jgruszka@agr.gov.sk.ca) and it will be added to the provincial survey.

Severe Winter Losses in Saskatchewan

Beekeepers across the province were surveyed to determine the winter losses for the winter of 2006-2007. Generally speaking, winter losses were more than double what is considered to be normal winter losses across the country. In Saskatchewan, winter losses generally are kept to between 10 to 15 per cent in a normal winter. This winter's losses, including small weak hives which would not produce honey, amounted to about 24 per cent of the colonies placed into winter. When compared to other parts of the country, these winter losses were at the low end of the scale compared to the severe winter losses which were sustained in New Brunswick, Alberta, and Ontario.

These higher than normal winter losses have been attributed to a number of factors. Primary among these appears to be lack of mite control. Secondly, the early spring weather was quite severe during which time many small hives dwindled or died.

Part of the higher winter losses in Saskatchewan were attributed to six commercial beekeeping operations in the north east of the province in which mite levels became extremely high over the course of the summer of 2006. By the time these high mite levels were noticed, colonies sustained significant damage to the

young brood emerging in the late summer and, as a consequence, these bees died prematurely during the winter. In some cases, the beekeepers were unaware that Apistan was no longer controlling the Varroa mites they had and needed to switch to Checkmite+.

Wintering bees outdoors in the prairie provinces has always been difficult. There are a number of stresses that go along with a long (six months) and very cold winter. During the last two decades the stress levels have been increased significantly by mites (first, the advent of the honeybee tracheal mite and secondly the arrival of the Varroa mite). Individually, either tracheal or Varroa mite infestations will increase winter mortality if allowed to get to significant levels within the colony. When colonies have both mites infesting their hives, the stress level increases exponentially and winter mortality can be increased significantly even at lower levels of infestation of both mites.

The added stress that the mites bring to the colony provides an opportunity for Nosema to become a factor in wintering. Thirty years ago Nosema was rarely seen as a significant wintering problem. Surveys at that time indicated that Nosema was usually not found in more than 30 per cent of the hives. Of those infected hives, less than 30

per cent of the colonies had levels high enough to warrant treatment.

More recently, because of the mite stresses, Nosema is becoming a more significant problem during winter. A new variety of Nosema has been discovered (*Nosema ceranae*) which is thought to be even more virulent than the *Nosema apis* that traditionally has been the pest in North America. Surveys conducted by Beaverlodge indicate that this new Nosema has been in Canada since at least 1994 but we are only now recognizing its potential to cause increased wintering mortality.

To minimize winter losses caused by these additional stresses, beekeepers need to sample their colonies in the spring to ensure that the mite control products they applied to their colonies have, in fact, reduced mite levels. It is also important to test in the fall to ensure that mite levels are low before winter begins. By testing in late August there is still a window of opportunity to treat in early September before or during the feeding of colonies. For those beekeepers who now have one or both mites, it is strongly advised to feed Fumadil in the first fall feeding to ensure that Nosema levels are reduced to absolute minimums and the bees go into winter with added protection to this stress.

Small Hive Beetle Survey

The Small Hive Beetle was found in Australia and reports have indicated that some packages arriving from Australia have contained small hive beetle. The beetles have been found in isolated cases in Manitoba and Alberta. This spring, I conducted a survey of several commercial beekeepers who were the major importers of Australian packages into Saskatchewan for the past two springs. I am pleased to report that no Small Hive Beetles were found. It is unlikely that Small Hive Beetle would have managed to survive and multiply due to our winter climate. We will continue to monitor for this pest but it does not appear to be present in Saskatchewan.

Checkmite+ Receives Full Registration

Some producers in Saskatchewan have been using Checkmite+ for a few years, as their Varroa mites have become resistant to Apistan treatments. For the past few years Checkmite+ has been made available on an emergency use registration permit. This past spring, Bayer received a full registration for the use of Checkmite+ in Canada. There are many beekeepers in the north east part of Saskatchewan for whom Apistan no longer works to control Varroa mites. These producers have made the switch to Checkmite+ or formic acid to control Varroa mite levels.

Know Your Mite Levels

In the spring of 2007 there were a handful of commercial operations that had huge winter losses, in excess of 70 per cent and higher. These losses were attributed to very high Varroa mite levels.

Every Beekeeper Needs to Sample for Varroa Mites

For beekeepers who know they have Varroa mites they need to sample to determine the levels of infestation and if treatments are working.

For those beekeepers who have not yet seen Varroa mites in their colonies they need to sample rather than assume that they do not have Varroa mites in their hives. Since Apistan-resistant Varroa mites have been found in the north east part of the province, as this spreads every beekeeper needs to sample to ensure that their treatment is working and be prepared to switch treatments when necessary.

Sampling



Figure 1: Sample jar with screen top

The most sensitive sampling technique is to use a sticky board and count the mite drop. This method is sampling the entire population rather than a sub sample which is done when using an alcohol wash or sugar shake method. The following information (provided by research from Dr. Rob Currie at the University of Manitoba) indicates the correlation between an alcohol wash sampling method and sticky boards to indicate the percentage infestation depending on the number of mites that drop in a 24-hour period whether it is a natural drop or using chemical treatments like Apistan or Checkmite+ and Formic acid.

Mites per 100 bees: Per cent infestation (200-300 bee sample)			
alcohol wash	drop on sticky boards (24 hours)		
	natural	Apistan/ Checkmite+	Formic acid
0 to 1%	½	0 to 30	5 to 15
3%	18 +/- 13	50 (1 strip) 185 (2 strips)	76
5 to 6%	33 to 43		

When using alcohol wash or a sugar shake, to make the results more reliable, then you need to sample at least two to three hundred bees. Before you start with either alcohol or sugar sampling method you need to determine for yourself how many bees in the bottom of a jar constitute one, two, and three hundred bee levels so that your percentage estimates are reliable.

To use the alcohol wash you can use windshield washer antifreeze (use the 40 degree material since it has a higher alcohol content). One needs to gather the sample in the alcohol, shake for at least two minutes, and then shake the bees through a screen to separate the mites from the bees. It is advisable to rewash the bees and shake at least three times until no further mites come from the sample.

A similar sampling procedure can be done with the sugar shake method except one uses icing sugar rather than alcohol. Bees live and can be returned to the colony. When shaking the mites out onto a surface on which they can be counted, it is best to have a grid marked on that surface so that the mites are easier to count. You want to do this out of the wind since the mites will be able to move and be blown about.



Figure 2: 300-bee sample

(Continued from page 5)

Economic Threshold Levels

This work was done by Dr. Rob Currie at the University of Manitoba (see page 7), but is applicable for colonies across the prairies. It is important to notice that the economic threshold levels vary depending on the time of year that the samples were taken. Sampling in the early spring, if Varroa mite levels are one per cent or less, a person can forego treatment. If the sample levels are three per cent or higher then treatment should be considered in the spring. If the sampling is done later in the spring or early summer, from May to July, then treatment levels above one per cent will need to be treated in the fall after the honey has been removed.

Sampling in the fall could reveal the need to treat for Varroa mite control. Again, one needs to make a distinction regarding the time of sampling and whether there is brood present in the hive or not. At the end of August or early September when there is brood present, the treatment threshold is approximately three per cent. For colonies that have less than a three per cent infestation treatment can be delayed until spring time. For colonies that have three per cent or higher then a fall treatment should be considered. You will notice that the treatment levels are higher if the sampling is done later in the fall. However, beekeepers are urged to sample early in case colonies that need to be treated are found since treatment options in October are limited.

Treatments

There are four registered treatments available to beekeepers in Canada. **Apistan** is the most common treatment still used in Saskatchewan. Some areas, particularly in the north-east, have developed Apistan-resistant mites. However, Apistan still works for the majority of beekeepers across the province.

Checkmite+ has recently been given full registration. Beekeepers in the north-east have made the switch from Apistan to Checkmite+ to combat resistant mites. Checkmite+ is as effective as Apistan but is a harsher chemical and has some repercussions on colonies so it should be used with caution.

Formic Acid is registered for use to control both tracheal mites and Varroa mites. To treat for Varroa mites, you need a higher level of concentration. Research has shown that for Formic to be effective against Varroa mites, it needs to be used spring and fall to obtain the same level of control that one treatment per year offers using the chemical products.

Note: In the following economic threshold chart, the Formic treatment indicates five individual treatments (three to five days apart). Alternately, the single treatment (Mite Away II) can be used in the spring and fall.

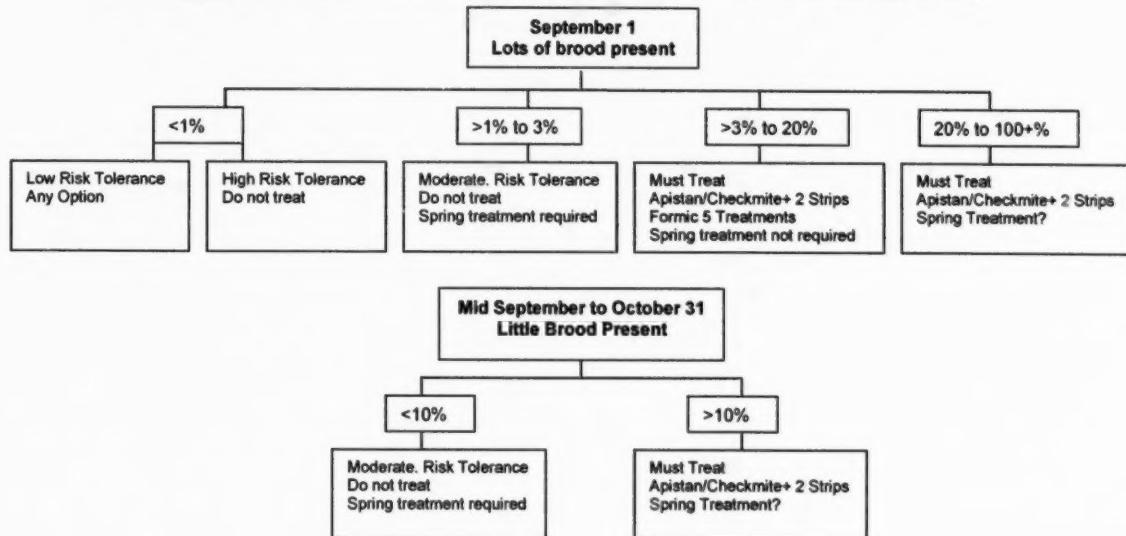
Oxalic Acid is registered for use in Canada. Under Saskatchewan conditions, it is most likely to be most effective when used in an evaporator in late fall after the colonies have been wrapped for winter. Oxalic Acid is most effective when there is little or no brood present since it cannot kill the Varroa mites within the brood. Oxalic is being suggested to be used with a sugar syrup drench in other jurisdictions, however, under our conditions it is unlikely to be effective. Outdoor wintered colonies already have brood in February, and the efficacy of Oxalic Acid using a sugar syrup drench would not be effective. Similarly, an early spring fumigation with Oxalic Acid would not work well for over wintered colonies because of the brood already present. Perhaps spring Oxalic Acid treatments could work for indoor wintered colonies if they are treated soon after they are removed from winter quarters and before there is capped brood present in the colony.

When you consider the replacement cost of a lost colony over winter, plus the lost honey production, you quickly recognize that the value of our beehives are approaching \$500. Sampling may seem to be tedious work, however, the mites add a significant stress load to the colonies over wintered, and need to be controlled at the lowest possible levels. The time and effort spent to keep colonies with low mite levels is well rewarded in strong populous colonies in the spring time that produce maximum honey crops.

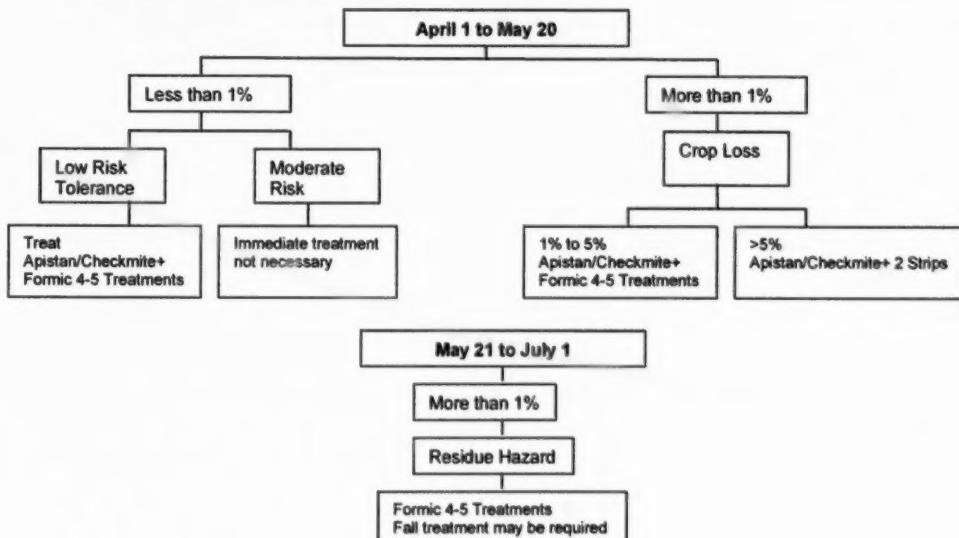
(see chart next page)

Economic Thresholds for Varroa in the Prairies
Dr. Rob Currie, University of Manitoba

For **FALL** based upon 200-300 bee alcohol wash (in the absence of tracheal mites)



For **SPRING** based upon 200-300 bee alcohol wash



2007 Lab Analysis Report

The tracheal mite analysis lab in Prince Albert analyzed almost 1,400 samples this summer. Generally, the tracheal mite levels have declined. This is likely an indication of good treatment weather both last summer as well as this year.

There are a handful of commercial beekeepers in the province who have still experienced difficulty with tracheal mites in that more than half of their apiaries are infested with tracheal mites. Infestation rates were generally low, but these individual producers have been struggling to get fewer apiaries showing positive. Although the tracheal mite levels have declined significantly, there continues to be tracheal mites in virtually all areas of the province.

Although we no longer are doing Varroa mite surveys using sticky boards, each of the apiary samples that are sent to the lab is shaken and screened for the presence of Varroa mites. Generally, the Varroa mite levels were very low, however, Varroa mites also are being found throughout the province.

This year, Beaverlodge Research Station has asked if we can collect adult bee samples to do a survey of the province to determine the presence and prevalence of the new form of Nosema (*N. ceranae*) in our honeybee population. To that end, a sub-sample has been taken for each beekeeper who submitted samples (taking a few bees from each of the sample jars and making a composite sample). These samples will be forwarded to Beaverlodge for processing this winter.

FOR SALE

Saskatoon Area Apiary For Sale. Equipment to operate a 55+ colony honey production operation. Approximately 30 two-story wintered colonies. Inspection certificate available. Alberta Honey Co-op membership and quota base.

CONTACT: Al Arsenault
SASKATOON (306) 249-1380 (evenings)

WANTED

4-frame extractor
CONTACT: H. Falkenberg
153 Jubilee Crescent, YORKTON S3N 0T4
(306) 782-1631

10-20 frame extractor,
stainless steel or very good plastic
2 bee hives
2 nucs
CONTACT: Ray Gaudet
266 14th Street W, PRINCE ALBERT S6V 3L3
(306) 922-1052 or (306) 922-4500

HONEYBEES WANTED. Six quarter organic farm with trees, ponds, red and yellow clover, alfalfa, etc. looking for bees to share the bounty this land provides. Free room and board available for interested bees.
CONTACT: Norbert Kratchmer
UNITY (306) 228-3588 or organicnorb@yahoo.ca

NOTICE

When purchasing used beekeeping equipment or live bees, ask to see a "Permit to Sell." The "Permit to Sell" will indicate if and when the equipment and bees were inspected for brood diseases and mites. Permits are available from the Provincial Apiculturist in Prince Albert. Phone (306) 953-2790 or e-mail jgruszka@agr.gov.sk.ca.